



RADIOMETRIC MEASUREMENTS OF A NEAR-AMBIENT, VARIABLE-TEMPERATURE NOISE STANDARD

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I. INTRODUCTION

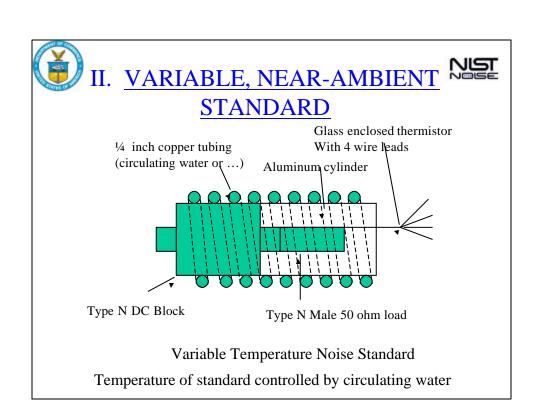
- Two current NIST-Noise projects involve measurements of noise temperatures near ambient:
 - microwave remote sensing of the earth
 - use of electronic tuners in noise-parameter measurements (noise temperature of the tuner)
- Want to check our capability near ambient
 - don't normally measure there
 - need (and think we have) very small uncertainties (~ 0.2 K or 0.3 K)

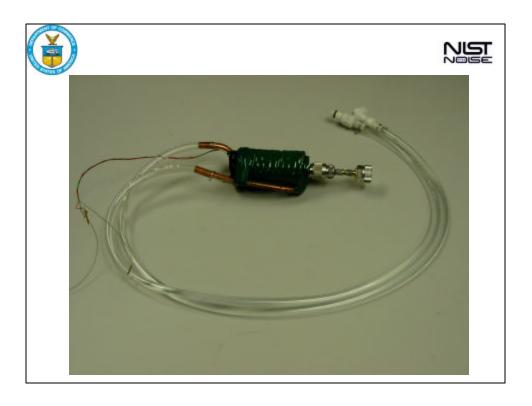




• Approach:

- build a near-ambient noise source/standard with variable noise temperature
- measure it over a range of noise temperatures and frequencies (2 12 GHz)
- compare measurement results to known noise temperature of the variable standard



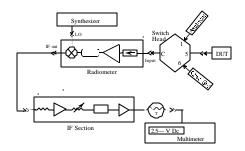




III. <u>MEASUREMENTS</u>

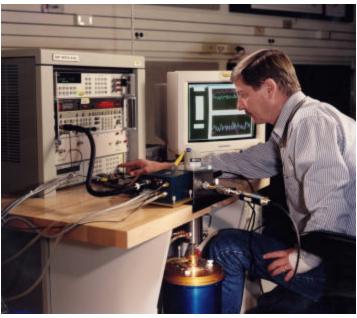


- Performed on the NIST coaxial radiometer (total-power radiometer, double sideband, baseband, 5 MHz bandwidth)
- Primary standards are coaxial cryogenic standard and coaxial ambient standard.







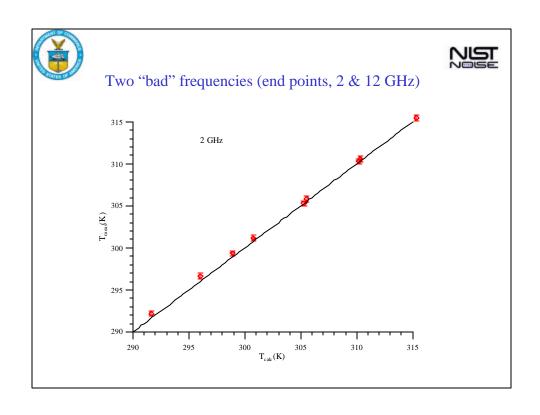


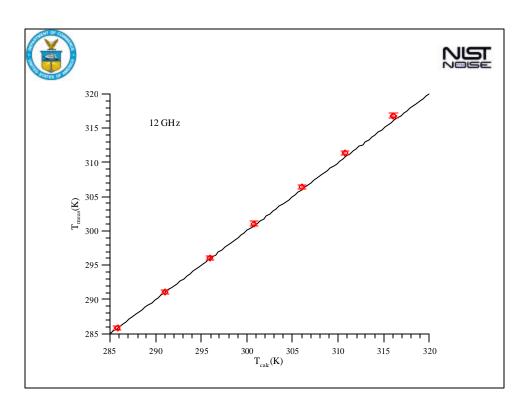


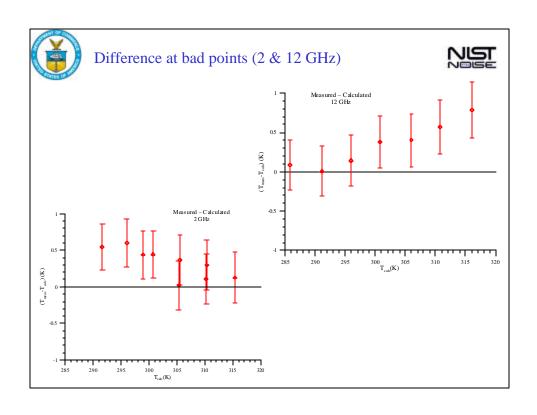
IV. RESULTS

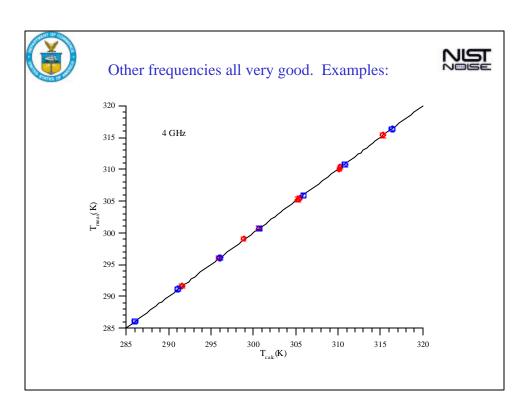


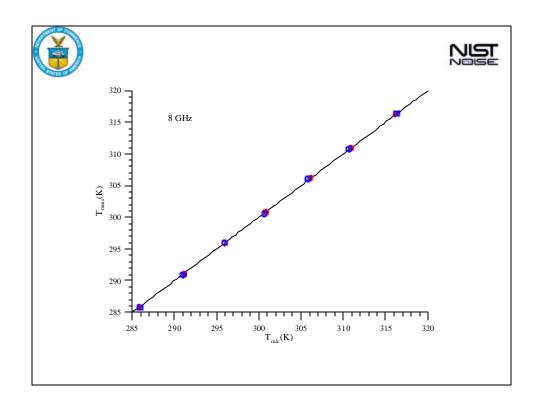
- Plot calculated (from temperature of variable standard) vs. measured noise temperature.
- Looks good at all frequencies, but not a good test (large scale, small deviations).
- Better test is to plot the difference.
- Error bars are standard uncertainty (k = 1) in measured value only, neglecting uncertainty in variable standard.

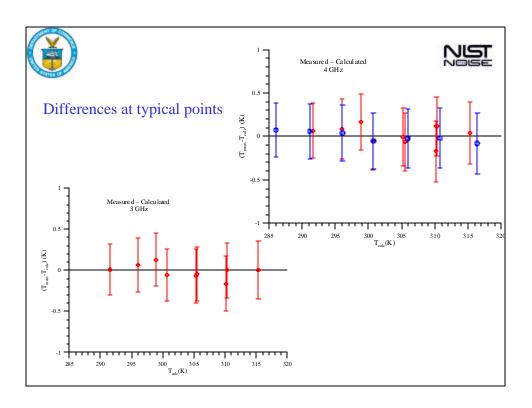


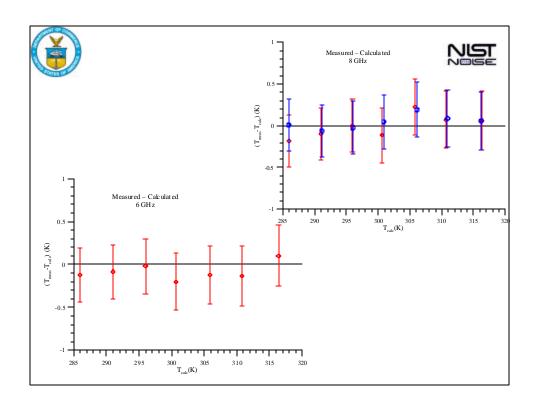


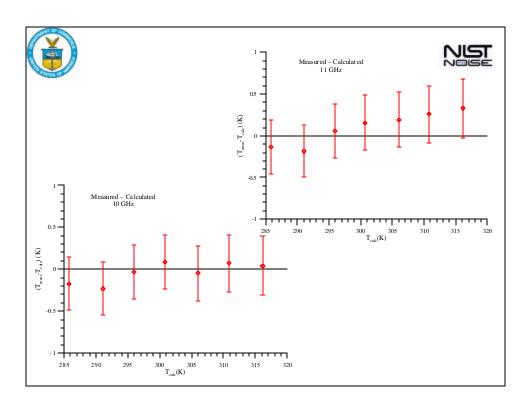
















V. **SUMMARY**

- Good agreement; even "bad" points agree within expanded (k = 2) uncertainties.
- At most frequencies, uncertainties appear to be overly conservative.
- Discrepancy at 2 GHz probably due to behavior of capacitor(s) in DC block in variable standard.
- Discrepancy at 12 GHz *may* be due to DC block (only rated to 12 GHz).





- Next:
 - check 12 GHz
 - extend temperature range of measurements (antifreeze)
 - variable standards & similar tests for higherfrequency, waveguide systems (?)